Exhibit 12

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On Oct. 18, 2001

TOWNSEND and TOWNSEND and CREW LLP

By: Alan Bowder

AMENDMENT UNDER 37 CFR 1.116
EXPEDITED PROCEDURE -
EXAMINING GROUP 2815

PATENT
Attorney Docket No.: 018865-001700US
Client Ref. No.: 17732/722600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Sze-Ki Mo, et al.

Application No.: 08/970,221

Filed: November 17, 1997

For: FIELD EFFECT TRANSISTOR AND METHOD OF ITS MANUFACTURE

Examiner: Jackson Jr., J.

AMENDMENT UNDER 37 CFR 1.116
EXPEDITED PROCEDURE EXAMINING
GROUP 2815

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Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

The following is submitted in response to the Final Office Action mailed August 2, 2001.

REMARKS

All claims remain rejected as being anticipated or otherwise unpatentable over Hshieh '543 and in combination with Darwish '725, Nakamura, Bencuya, and Harada. Specific rejections were discussed during a telephone interview with the Examiner on October 18, 2001. Applicants' responses to the various rejections were

further explained during the interview, at the conclusion of which the undersigned was asked to resubmit the responses in a summary format.

1. "Abrupt" junction not a "mere label"

It is the understanding of the undersigned that the rejection is partly based on the belief that the term "abrupt" when characterizing a junction as set forth in claims 1, 8 and 47, is "merely a label which does not structurally distinguish" over the applied art. As presented in the previous response filed on June 7, 2001 (hereinafter "the 6/7/01 response"), pages 5-7, one of skill in this art would immediately recognize an "abrupt junction" as being a type of junction with specific structural features that is distinct from a "linearly graded junction." This significant distinction both in terms of structure and properties of the abrupt junction versus the more commonly found linearly graded junction is thoroughly analyzed, for example, by S.M. Sze in the seminal book titled "Physics of Semiconductor Devices," under section 2.3.1 titled "Abrupt Junction." The details of the definition and structural properties of the abrupt junction versus the linearly graded junction were previously provided in the 6/7/01 response at pages 5-7, and will not be repeated. Applicants respectfully submit that as recognized by all those skilled in this art "abrupt" as applied to a junction clearly defines specific structure and properties and is neither "merely a label" nor devoid of structural significance.

2. Hshieh '543 does not teach or suggest an "abrupt junction"

The rejection maintains that Hshieh '543 shows "an abrupt junction" stating that "p+ region 24 makes an abrupt junction with p layer 18 similar to applicant's invention." Applicants respectfully stress that there are a number of reasons supporting the fact that Hshieh '543 indeed does not teach or suggest the use of an abrupt junction. First, the word "abrupt" is not mentioned even once any where in Hshieh '543. This is significant in large part because of the fact that the term "abrupt" is not a mere label and defines significant structural properties. The most common type of junction is the lineally graded junction as it typically results from commonly employed diffusion

processes. The abrupt junction, on the other hand, typically requires additional processing steps (e.g., double implant) or other types of specific processing variations to obtain. Thus, because of the significant difference in its structure and its properties as well as its special processing requirements, unless expressly defined as being abrupt, a junction is commonly assumed to be linearly graded. A linearly graded junction would be the appropriate assumption made by one of ordinary skill in the art reading Hshieh '543.

Furthermore, whether a junction is linearly graded or abrupt depends on several different but inter-dependent variables including background doping concentration, target breakdown voltage, etc. as explained by Sze. Hshieh '543 does not provide enough information to determine conclusively whether the junction between layers 18 and 24 is or is not abrupt. Therefore, it is not possible for the Applicants to prove based on the disclosure in Hshieh '543 that the junction is not abrupt. However, Hshieh's failure on both counts; to expressly define the junction as abrupt and to provide enough information to deduce that the junction may be abrupt, demonstrates that Hshieh did not contemplate the use of an abrupt junction. Nor would any one else skilled in this art reading Hshieh '543 come away with an understanding that the junction between layers 18 and 24 is abrupt.

This is further supported by the fact that Hshieh expressly teaches that "regions 24 may be shallower, in which case the breakdown current conduction path is from body region 18 to buried layer 16." [Hshieh '543, col. 3, lines 3-5]. This clearly underscores Hshieh's understanding that, not only a shallower "P+ body contact region 24" is for contact purposes (as the title clearly defines it as such), once made shallower than the body region 18, the P+ body contact region 24 becomes irrelevant vis-à-vis the location of the breakdown current (which Hshieh then teaches is controlled by buried layer 16). That is, since Hshieh clearly believes that a P+ body region 24 that is shallower than body region 18 does not impact the location of the breakdown current,

there would be no need to make the junction special in any way, whether abrupt or otherwise.

3. "Abrupt junction" not obvious

Another concern raised by the Examiner relates to whether the use of an abrupt junction would have been obvious even if Hshieh '543 does not explicitly teach it. In addition to the fact that none of the applied art mentions or even suggests the use of an abrupt P+ body-to-body junction, at least two other arguments were presented in the 6/7/01 response each of which makes a very strong case for why the use of an abrupt junction in combination with the other elements as claimed is not obvious. These arguments are summarized below.

(i) Long-standing Problem

Applicants submit that many of the most skilled artisans in the field had long recognized and struggled with the exact same set of challenges (e.g., increased trench MOSFET cell density, improved breakdown voltage, lowered transistor on-resistance, etc.), yet none were able to conceive of the solution claimed by the present invention. Instead, in each instance, the prior art proposes a solution that is fundamentally different both structurally and functionally, as well as being technically inferior as demonstrated by the commercial success of the products manufactured based on the present invention.

The 6/7/01 response presented, at pages 11-15, an analysis of five patents, Hshieh '543, Darwish '725, Hshieh '128, Bulucea et al. '266 and Williams '836 (all assigned to Siliconix), demonstrating that for well over a decade engineers in the field have attempted to arrive at a design for a trench MOSFET that addresses breakdown voltage, on-resistance and cell density in an optimized fashion. The analysis also demonstrated that time and again a solution was proposed that is very different than that found by the Applicants. If the present invention as claimed were obvious one would

have to ask why then did no person of skill in the art arrive at this solution years ago. One answer to this question may be the fact that there has been a general understanding by those skilled in this art that, in terms of impact on the electric field, between the deeper well (or body) region and a heavily doped body region that is shallower than the well, the deeper well region (that is closest to the epitaxial layer) dominates. This had led to a generally accepted assumption that such shallow heavy body junction inside a graded body junction, no matter how deep, could not have any measurable impact on breakdown voltage.

Challenging these and other accepted assumptions, and through exhaustive experimentation and computer simulations, Applicants were the first to find that the problem can in fact be addressed optimally by employing, in combination with the other features of the transistor, a shallow heavy body with specific depth and junction characteristics. The solution offered by the instant invention requires no additional structures as proposed by numerous prior art references such as buried layers or dual epitaxial layers, delta layers, protective PN junction diodes, deep P+ body regions, etc.

(ii) Commercial Success

As a direct result of the Applicants' elegant and superior solution to the long-standing problem, which has clearly not been taught or suggested by the art of record, a family of trench MOSFET products manufactured by Fairchild Semiconductor has enjoyed tremendous commercial success. A declaration by Dr. Izak Bencuya, a co-inventor and a Vice President of Fairchild Semiconductor (the assignee of instant application) was submitted along with the 6/7/01 response to provide further objective evidence of non-obviousness of the claimed invention. In addition to the favorable product reviews by trade publications, statistical data was provided to illustrate the commercial success of the product. One particularly telling statistic is the dramatic shift in the trench MOSFET market share between Fairchild Semiconductor and Siliconix in a matter of about three years from the introduction of the Fairchild product manufactured

based on the instant invention. Siliconix's approximately 85% share of the trench MOSFET product has been reduced to about 50% with Fairchild now owning 30% of the that market, and this trend is continuing at the same rapid pace.

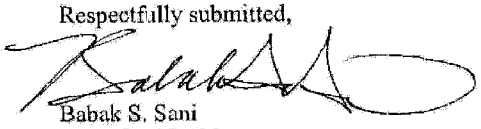
4. Hshieh '543 does not teach or suggest "adjusted" relative depths

Finally, the 6/7/01 response presented several other grounds that patentably distinguished the claims over the cited references. Among these, is the claimed feature relating to the relative depth of the "heavy body" and the "well" being "adjusted so that a transistor breakdown initiation point is spaced away from the trench." The rejection states that "Arguments regarding 'adjusted' are also unconvincing of patentablity because the Hshieh functions in the same manner and therefore is likewise 'adjusted.'" As it has already been made clear above, Hshieh '543 does not function in the same manner. Hshieh '543 expressly teaches to use a "buried layer 16" to relocate the breakdown initiation point (col. 3, lines 3-5), and does not do so by adjusting the relative depths of the P+ and the well regions.

CONCLUSION

Applicants appreciated the opportunity to discuss the merits of the pending claims with the Examiner on October 18, 2001, and invite the Examiner to call if a telephone conference would expedite prosecution of this application. It is believed that in view of telephone interview and the foregoing summary of the grounds for patentability, all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Respectfully submitted,



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First Named Inventor	Sze-Ki Mo, Brian
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